

glowing-point; again a dark interval follows, shorter than the first, and behind it a long strip with a dark core and very faintly bright edges; as one traces backwards, the edges appear to close in together gradually, so that, after about two inches, the dark core has collapsed, as it were, and the edges have come together to form a narrow and well-defined thread of a mauve tinge; this gradually dies away as we go further back along the trail, and by the time that the glowing-point has travelled over the whole curve once, it has nearly disappeared.

Secondly, let the figure of eight be as large as can be described in a rectangle 8 inches by 4. Here the phenomena are quite different. It now seems as if the dark intervals at either end of the ghost as described above were absent, and the ghost itself were drawn out into a streak which follows *immediately* upon the glowing-point. Its colour is now yellow-green. This gradually narrows to extinction as one traces the trail backwards, and is the positive after-image in its various stages. More probably this streak has no connection with the true *ghost*; but is quite distinct from it, whilst the ghost no longer appears, when the point moves with greater velocity. In fact, there is probably a limiting velocity of the glowing-point, beyond which the ghost is not formed. This coincides with Mr. Bidwell's observations as to the rate of rotation of the vacuum-tube. As the yellow streak disappears narrowing, one sees a faint blue haze on either side, separated from it by an interval of darkness. When one has traced backwards so far that the streak has vanished, one sees what was above described as a strip with dark core and faint blue or mauve edges. The edges close in and form a distinct mauve thread, which gradually dies out.

It is very beautiful to see the ghostly trail hanging before one; and, by suitable movement of the glowing point, one may fill the space, as it were, with a maze of wreathing lines. Perhaps the most striking part of the phenomenon, regarded from an æsthetical standpoint, is the *depth* of the figures so produced: one realises in the form of the trail that the glowing-point has been moving, not in one plane, but in space; and one sees that some parts are nearer than others. After a time the glowing-point seems to be forgotten, and the trail is the only thing observed. The position of the trail appears to change with any change in the state of accommodation of the eye; if the trail goes away from one the eye attempts to follow it, and exaggerates the movement. If there is any irregularity in the curve, as may often be the case from want of proper co-ordination of muscles—especially if the moving arm is at all subject to rheumatism—it is revealed in a terribly truthful manner by the trail.

A systematic investigation of the subject would, I think, be very valuable as throwing light upon the processes in the retina.

Both Prof. Young ("whatever the true explanation may turn out to be, the phenomenon at least suggests the idea of a *reflection of the nervous impulse* at the nerve extremities, as if the intense impression upon the retina, after being the first time propagated to the brain, were then reflected, returned to the retina, and, travelling again from the retina to the brain, renewed the sensation") and Mr. Bidwell ("the series of phenomena seem to be due to an affection of the optic nerve which is of an oscillatory character," &c.) appear to incline to what I may call a *physical* view of the phenomena. The phenomena appear to me to point to some *chemical* action on the retina, and to depend in a great measure on the *rate* at which this action goes on. It would be of great interest to consider the phenomena in connection with Hering's theory of colour sensation; according to it these sensations are due to changes in a certain substance, in such a way that changes of a destructive or dissimilative character give rise to the sensations of white, red, and yellow, whilst those of a constructive or assimilative kind produce the sensations of black, green, and blue ("Zur Lehre vom Lichtsinne," Wien, 1878). It may be that this work has been already done; if so I must crave the indulgence of those who have made the subject a special study.

H. FRANK NEWALL

Crowthorne, Wokingham, May 18

"Speed" and "Velocity"

SOME of your "general" readers, like myself, may wish to see the distinction between "velocity" and "speed" more easily defined than by a reference to the calculus of quaternions, to which I believe the term "tensor" appertains.

"Speed" is not in the index to the new edition of Part II. of

Thomson and Tait. Maxwell, at p. 26 of "Matter and Motion," says, "The rate or speed of the motion is called the velocity of the particle." Tate, in his "Properties of Matter," p. 52, writes about "water of motion; i.e. *Speeds*." It seems thus:—

- (1) Rate of motion is velocity (Maxwell)
- (2) Speed of motion is velocity
- (3) Rate of motion is speed (Tate).

From (1) and (3) it appears as if velocity and speed must be the same, as indeed (2) seems to assert. But we are told this is not the case. Cannot the distinction between the two be made more generally intelligible than by saying that "speed" is the "tensor" of velocity.

SENEX

[When Maxwell introduced to junior students the *Diagram of Velocities*, he made velocity include the *direction* of motion as well as the mere *rate* of motion (i.e. speed).—ED.]

The Male Sole is not Unknown

IN last week's issue of NATURE is what is said to be an abstract of a paper read at the Society of Arts by Prof. Ray Lankester, in aid of a proposed marine laboratory, and, passing over what he stated generally requires elucidation, he gives one example of *what is not known among fishes*, and which in the first instance will be investigated at Plymouth. He is made to say "at present absolutely nothing is known as to the spawning of the sole—the male fish is not even recognised."

In times gone by the plaice was asserted to have ascended from a shrimp, but this, I think, is the first time that the existence of the male sole has been declined recognition. Omitting references to others, I will merely draw attention to the fact that in my collection of British fishes in spirit at the "Great International Fisheries Exhibition," and which is now deposited in the Economic Museum at South Kensington, is a fine example of the male sole, with the milt quite ripe.

I must apologise for pointing out the foregoing, but were such an error left unnoticed in a scientific paper, some practical fisherman will possibly direct attention to it, as the comparative rarity of the male to the female sole has been frequently observed upon in our weekly sporting journals during the last few years.

Cheltenham, May 23

FRANCIS DAY

The Aurora of March 15, 1885

NATURE for March 26 (p. 479) contains an account of a fine aurora observed at Christiania, Sweden, on March 15, by Prof. Sophus Tromholt. I would call attention to the fact that an aurora (a very unusual phenomenon at this place) was visible here on the evening of March 15. It was first seen at about 7 p.m.

At the above time several streamers were noticed ascending somewhat east of north: after a short interval these died leaving a white nebulous cloud of light at an altitude of about 10° near a point some 10° or 15° east of north. Shortly afterwards streamers appeared ascending some 10° or 15° west of north; these presently disappeared, leaving a mass of light similar to that left in the east of north. Several times feebler streamers made their appearance west of north. The rays did not attain a greater height than some 20° , and by 8 $\frac{1}{2}$ h. all was quiet, save an auroral glow along the horizon some few degrees east of north, which remained throughout the night. I have thought this might be interesting in connection with the Christiania aurora.

Longitude west of Washington = oh. 39m. 0 \cdot 68s.
Latitude = +36h. 8m. 58.25s.

E. E. BARNARD

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Catalogue of Fossil Mammalia in the British Museum. Part I.

IN reply to Mr. Lydekker's comments on the review of his work (NATURE, vol. xxxi. p. 597) I am glad to find that the author repudiates the Owenian system and its errors, though his recognition of the three upper premolars in *Vespertilio* as corresponding, respectively, to *pms.* 2, 3, and 4 of the typical series of four, and the minute anterior upper premolar of *Rhinolophus* as *p.* 3, added to the strange absence of any note on the presence of exceptions to the supposed rule that the premolars decrease in number by reduction from the anterior extremity of the series

would certainly lead any one acquainted with the subject to believe that he had acted on it. The only clues afforded by the work which indicate that the Owenian system was not adopted in its entirety, now pointed out by Mr. Lydekker as existing at pp. 152, 174, would certainly escape the notice of any one who had not actually spelled through the work, as I feel sure whoever will take the trouble to refer to will agree with me.

There is no evidence whatever to support Mr. Lydekker's assumption that the two anterior premolars in *Vespertilio* and the anterior premolar in *Rhinolophus* correspond, respectively, to *pms.* 2 and 3 and to *p.* 3 of the typical series. On the contrary, the small size of the second premolar in *Vespertilio* points to reduction by loss from the middle of the series, as we find in the greater number of species of the closely-allied order, Insectivora, and, as we know, takes place in the mandible of several species of Chiroptera.

With reference to the wish expressed in the review that, instead of writing a mere catalogue of the fossil mammals in the British Museum, Mr. Lydekker had undertaken one of all the known species, and his objection, while regretting that the intended friendly estimate of his capability for such a work has been so hostilely received, I maintain that such should have been undertaken; but Mr. Lydekker's remarks show how necessary it is, and that the objection that new genera and species are being made almost daily (it is probable that they will continue to be made to the end of time) might be applied with equal force on behalf of the birds by Mr. Sharpe, who nevertheless continues his excellent catalogue. It is only by the publication of such a work that we can hope to limit the manufacture of "empty names," such as Mr. Lydekker objects to, and to reduce to order the vast amount of scattered information and contesting opinions which encumber the study of the subject.

THE REVIEWER

THE ORCHID EXHIBITION

THE Exhibition held in the Conservatory at South Kensington on the 12th and 13th inst. in connection with the Orchid Conference of the Royal Horticultural Society, must have furnished to the least observant visitor some explanation of the fascination exercised by orchids over their cultivators. The beauty, the variety, the strangeness of the flowers of the Orchidæ attract and interest the least enthusiastic even of the lovers of nature. But the variation in flower, compatible with botanical inclusion in one family, is not more marked than is the difference in mode of flowering and of growth. Could there be in one natural order a stronger contrast than between the mode of growth and the gorgeous flowers of the genus *Cattleya*—essentially "flaunting flowers"—and those of the genus *Masdevallia*, where the conspicuous part of the flower consists of the three sepals, drawn out in many species into thread-like tails many inches long, and ranging in colour through every shade of orange, scarlet, and purple, down to an almost inky black!

While a larger array of specimen plants has often been seen than was shown at the Conference, there has never been gathered together in any country so varied and interesting a collection, nor one containing so many rare and curious plants. Great as was the interest for the cultivator, it was no less great for the botanist. Mr. Ridley, of the Natural History Museum, who, in conjunction with Mr. Burbidge, of the Dublin Botanic Gardens, has undertaken to draw up a report on the Conference Exhibition, found that sixty-one genera of orchids were represented. For the first time in the history of flower-shows there was a numerous collection of hybrid orchids, raised by artificial fertilisation, in flower. For the first time was there a large collection of orchids in fruit. The progress of hybridisation, greatly due to the energy and skill of Messrs. Veitch and Sons and their intelligent foremen, Mr. Dominy and Mr. Seden, has already been fertile in valuable results for the cultivator. An excellent little book lately published,¹ gives a list of eighty-nine hybrids already in cultivation,

¹ "Orchids: a Review of their Structure and History." Illustrated. By Lewis Castle. (Journal of Horticulture Office, 171, Fleet Street, E.C.)

distributed among twelve genera; but thirty-seven of them belonging to the genus *Cypripedium*. Those who are privileged to enter the penetralia at Chelsea know that there are there and elsewhere great numbers and varieties of hybrids, which are slowly surmounting the dangers and delicacy of infancy and childhood.

But the labours of the hybridiser promise to be of great value to the botanist. Mr. Harry Veitch, in his very suggestive and interesting paper on the "Hybridisation of Orchids," read at the Conference, says: "How will these bigeneric crosses affect the stability of the genera as at present circumscribed?" It is well established already that the genera *Loelia* and *Cattleya* cross freely with one another, and Mr. Veitch refers in his paper to two other bigeneric hybrids, which have already flowered, and to others which have been raised, but have not yet flowered.

Unfortunately it must be a long time before orchid cultivators generally can enjoy the results of hybridisation. Mr. Veitch gives the time the hybridist must wait to see the result of his labours, as follows:—

Genus.	Time from Germination to Flowering
<i>Dendrobium</i>	3 to 4 years.
<i>Phaius</i>	About the same.
<i>Calanthe</i>	
<i>Masdevallia</i>	4 to 5 years.
<i>Chysis</i>	
<i>Zygopetalum</i>	5 to 9 years.
<i>Lycaste</i>	7 to 8 years.
<i>Loelia</i>	10 to 12 years.
<i>Cattleya</i>	

With the exception of the genera *Dendrobium* and *Cypripedium*, it is a long time before sufficient plants of a hybrid can be obtained for distribution, even under the most skilful cultivation. For this reason many of the more beautiful hybrids will probably remain scarce and valuable for years. The high prices paid by collectors for orchids in some cases have been a source of merriment to the uninitiated. Speaking generally, orchids were never so cheap or so plentiful. But if a collector must have a hybrid which has been raised by skilful hands and nursed into vigour by years of patient care—or, on the other hand, must have a beautiful natural variety which has been picked out of millions of plants—if he must have them, he must pay for them.

The Royal Horticultural Society is to be congratulated both on the botanical and the horticultural results of the late Conference. The Conference was a new idea, a new departure. It has demonstrated the great, widespread, and, better still, the intelligent interest taken in a singular and beautiful natural order, and the skill brought to bear on its cultivation.

The short scientific contributions of Prof. Reichenbach, whose absence was universally regretted; the paper on "Hybridisation," by Mr. Veitch, and the brief discussion which ensued, were listened to by a large and appreciative conference. The paper on "Cultivation," by Mr. O'Brien, was also interesting and valuable. The very difficult question of nomenclature, which is in so confused and unsatisfactory a state as to ill brook delay, was postponed. It could not be discussed with advantage at the tail of a long meeting, and will be referred, it is to be hoped, to a scientific committee selected from botanists in and out of the Royal Horticultural Society.

T. L.

WHEAT-PRODUCTION IN INDIA¹

INDIA has recently exhibited her extraordinary powers as a wheat-producing area of vast extent. Up to the year 1877 the British wheat-grower looked upon the exhaustless prairies of the far West as his most formidable

¹ The Wheat-Production and Trade of India. Calcutta. Being a collection of correspondence in continuation of papers published in 1879.